

What is claimed is:

1. A method for efficient QoS signaling for Mobile IP protocol using RSVP framework in which mobile nodes are connected to correspondent nodes via a plurality of intermediate nodes, comprising the steps of:

initiating in the mobile node a first PATH message for upstream data;

sending the first PATH message from the mobile node to the correspondent node via intermediate nodes;

initiating in the correspondent node a first RESV message for upstream data;

sending this RESV message from the correspondent node to the mobile node via the intermediate nodes;

thereafter sending REFRESH (periodic PATH and RESV) messages only between intermediate nodes;

initiating in the correspondent node a first PATH message for downstream data;

sending the first PATH message from the correspondent node to the mobile node via intermediate nodes;

initiating in the mobile node a first RESV message for downstream data;

sending the first RESV message from the mobile node to the correspondent node via the intermediate nodes; and

thereafter sending REFRESH (periodic PATH and RESV) messages only between intermediate nodes.

2. The method according to claim 1, wherein REFRESH messages are exchanged between the intermediate nodes, wherein the mobile node is attached to a first node of the intermediate nodes by a wireless link, and wherein subsequent REFRESH messages do not traverse the wireless link.

3. The method according to claim 1, wherein the correspondent node is attached to a second node of the intermediate nodes by a further wireless link, and wherein subsequent REFRESH messages do not traverse the further wireless link.

4. The method according to claim 1, wherein the mobile node is attached to a first node of the intermediate nodes by a wireless link, and wherein initial PATH messages and initial RESV messages traverse the wireless link.
5. The method according to claim 1, wherein the correspondent node is attached to a second node of the intermediate nodes by a further wireless link, and wherein initial PATH messages and initial RESV messages traverse the further wireless link.
6. A method for efficient QoS signaling for Mobile IP protocol using RSVP framework in which mobile nodes are connected to correspondent nodes via a plurality of intermediate nodes, comprising the steps of:
 - initiating in the mobile node a first PATH message for upstream data;
 - sending the first PATH message from the mobile node to the correspondent node via intermediate nodes;
 - initiating in the correspondent node a first RESV message for upstream data;
 - sending the first RESV message from the correspondent node to the mobile node via the intermediate nodes;
 - forming a proxy REFRESH generation function for upstream data in a node that is close to the mobile node in the end-to-end packet path and a proxy REFRESH interception function for upstream data in a node that is close to the correspondent node in the end-to-end packet path, so that the REFRESH messages do not traverse the wireless links;
 - initiating in the correspondent node a first PATH message for downstream data;
 - sending the first PATH message from the correspondent node to the mobile node via intermediate nodes;
 - initiating in the mobile node a first RESV message for downstream data;
 - sending the first RESV message from the mobile node to the correspondent node via the intermediate nodes; and
 - forming a proxy REFRESH generation function for downstream data in a node that is close to the correspondent node in the end-to-end packet path and a proxy REFRESH interception function for downstream data in a node that is close to the mobile node in the

end-to-end packet path, so that the REFRESH messages do not traverse the wireless links.

7. The method according to claim 6, wherein a proxy REFRESH generation function for upstream data generates PATH REFRESH messages on behalf of the mobile node.

8. The method according to claim 6, wherein a proxy REFRESH interception function for upstream data responds to the PATH REFRESH message by sending RESV REFRESH message on behalf of the correspondent node, if the latter is attached using the further wireless link; and

does not allow PATH REFRESH message to be transmitted over the further wireless link.

9. The method according to claim 6, wherein a proxy REFRESH generation function for downstream data generates PATH REFRESH messages on behalf of the correspondent node.

10. The method according to claim 6, wherein a proxy REFRESH interception function for downstream data responds to the PATH REFRESH message by sending RESV REFRESH message on behalf of the mobile node, if the latter is attached using the wireless link; and

does not allow PATH REFRESH message to be transmitted over the wireless link.

11. The method according to claim 1, wherein the method further comprises performing proactive RSVP signaling for upstream data at the time of handover of mobile node from one access router to another.

12. The method according to claim 1, wherein the method further comprises performing proactive RSVP signaling for downstream data at the time of handover of mobile node from one access router to another.

13. The method according to claim 11, wherein the method further comprises the steps of:

transferring PATH state block and RESV state block for uplink data from an old access router to a new access router;

sending from the new access router the PATH message for the upstream data along the new packet path; and

sending from the correspondent node the RESV message for the upstream data along the new packet path; and

intercepting this RESV message at the new access router.

14. The method according to claim 13, wherein the method further comprises informing the access router to which correspondent node is attached not to reserve any new link resources for the sent RESV message for upstream data.

15. The method according to claim 14, wherein the correspondent node communicates with the access router using link-layer signaling to instruct it not to reserve any new link resources in response to the sent RESV, and instructing the access router to map the sent RESV to already allocated link resource for the mobile node's packet session, thereby avoiding double reservation on the wireless link.

16. The method according to claim 13, wherein the PATH state block and the RESV state block are modified before transferring to reflect a new care-of address of the mobile node.

17. The method according to claim 13, wherein fast handover protocol and context transfer protocol are used to transfer PATH and RESV state blocks for upstream data from the old access router to the new access router.

18. The method according to claim 12, wherein the method further comprises the steps of:

inferring at the correspondent node upon receiving the PATH message for upstream data from the new access router where mobile node is being handed off, about the impending handover of the mobile node using higher layer information;
sending the PATH message from the correspondent node for downstream data along the new packet path; and
intercepting this PATH message at the new access router; and
sending RESV from the new access router to the correspondent node for the downstream data along the new packet path.

19. The method according to claim 18, wherein the correspondent node upon receiving the PATH message for upstream data from the new access router, infers about the impending handover of the mobile node using the binding of transport layer (UDP or TCP) port with the application.

20. The method according to claim 13, wherein the method further comprises sending subsequent PATH REFRESH messages for the upstream data from the new access router along the new packet path on behalf of the mobile node.

21. The method according to claim 13, wherein the method further comprises the steps of:

intercepting at the access router to which correspondent node is attached, the subsequent PATH REFRESH messages for the upstream data arriving along the new packet path;
initiating at the access router to which correspondent node is attached, the subsequent RESV REFRESH messages for the upstream data; and
sending the RESV REFRESH messages along the new upstream packet path.

22. The method according to claim 13, wherein the method further comprises intercepting subsequent RESV REFRESH messages for the upstream data at the new access router so that they do not traverse the wireless link to which the mobile node is attached.

23. The method according to claim 18, wherein the method further comprises sending subsequent PATH REFRESH messages for the downstream data from the access router to which correspondent node is attached along the new packet path on behalf of the correspondent node.
24. The method according to claim 18, wherein the method further comprises intercepting subsequent RESV REFRESH messages for the downstream data at the access router to which correspondent node is attached so that they do not traverse the wireless link to which the correspondent node is attached.
25. The method according to claim 13, wherein the method further comprises the steps of:
comparing at the new access router, the RESV message for upstream data with the transferred RESV state block from the old access router; and
informing the result to the mobile node.
26. The method according to claim 25, wherein the method further comprises deciding at the mobile node whether to continue the packet session in case the required resource is not available along the new packet path.
27. The method according to claim 26, wherein the method further comprises tearing down the packet session if the resource availability along the new packet path is not acceptable to the mobile node.
28. The method according to claim 26, wherein the method further comprises adapting the mobile node's application to the resource availability along the new packet path.
29. The method according to claim 6, wherein the method further comprises using a flow ID number in RSVP messaging to identify packet flow.

30. The method according to claim 29, wherein the flow ID number is calculated by hashing a known block of data with user specific key.
31. The method according to claim 30, wherein the user specific key is chosen by a user, and is at least one of a password or a pet word.
32. The method according to claim 29, wherein the method further comprises mapping multiple RSVP FILTER_SPECS to a resource that is identified by the flow ID number.

10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60
61
62
63
64
65
66
67
68
69
70
71
72
73
74
75
76
77
78
79
80
81
82
83
84
85
86
87
88
89
90
91
92
93
94
95
96
97
98
99
100
101
102
103
104
105
106
107
108
109
110
111
112
113
114
115
116
117
118
119
120
121
122
123
124
125
126
127
128
129
130
131
132
133
134
135
136
137
138
139
140
141
142
143
144
145
146
147
148
149
150
151
152
153
154
155
156
157
158
159
160
161
162
163
164
165
166
167
168
169
170
171
172
173
174
175
176
177
178
179
180
181
182
183
184
185
186
187
188
189
190
191
192
193
194
195
196
197
198
199
200
201
202
203
204
205
206
207
208
209
210
211
212
213
214
215
216
217
218
219
220
221
222
223
224
225
226
227
228
229
230
231
232
233
234
235
236
237
238
239
240
241
242
243
244
245
246
247
248
249
250
251
252
253
254
255
256
257
258
259
260
261
262
263
264
265
266
267
268
269
270
271
272
273
274
275
276
277
278
279
280
281
282
283
284
285
286
287
288
289
290
291
292
293
294
295
296
297
298
299
300
301
302
303
304
305
306
307
308
309
310
311
312
313
314
315
316
317
318
319
320
321
322
323
324
325
326
327
328
329
330
331
332
333
334
335
336
337
338
339
3310
3311
3312
3313
3314
3315
3316
3317
3318
3319
33100
33101
33102
33103
33104
33105
33106
33107
33108
33109
33110
33111
33112
33113
33114
33115
33116
33117
33118
33119
331100
331101
331102
331103
331104
331105
331106
331107
331108
331109
331110
331111
331112
331113
331114
331115
331116
331117
331118
331119
3311100
3311101
3311102
3311103
3311104
3311105
3311106
3311107
3311108
3311109
3311110
3311111
3311112
3311113
3311114
3311115
3311116
3311117
3311118
3311119
33111100
33111101
33111102
33111103
33111104
33111105
33111106
33111107
33111108
33111109
33111110
33111111
33111112
33111113
33111114
33111115
33111116
33111117
33111118
33111119
331111100
331111101
331111102
331111103
331111104
331111105
331111106
331111107
331111108
331111109
331111110
331111111
331111112
331111113
331111114
331111115
331111116
331111117
331111118
331111119
3311111100
3311111101
3311111102
3311111103
3311111104
3311111105
3311111106
3311111107
3311111108
3311111109
3311111110
3311111111
3311111112
3311111113
3311111114
3311111115
3311111116
3311111117
3311111118
3311111119
33111111100
33111111101
33111111102
33111111103
33111111104
33111111105
33111111106
33111111107
33111111108
33111111109
33111111110
33111111111
33111111112
33111111113
33111111114
33111111115
33111111116
33111111117
33111111118
33111111119
331111111100
331111111101
331111111102
331111111103
331111111104
331111111105
331111111106
331111111107
331111111108
331111111109
331111111110
331111111111
331111111112
331111111113
331111111114
331111111115
331111111116
331111111117
331111111118
331111111119
3311111111100
3311111111101
3311111111102
3311111111103
3311111111104
3311111111105
3311111111106
3311111111107
3311111111108
3311111111109
3311111111110
3311111111111
3311111111112
3311111111113
3311111111114
3311111111115
3311111111116
3311111111117
3311111111118
3311111111119
33111111111100
33111111111101
33111111111102
33111111111103
33111111111104
33111111111105
33111111111106
33111111111107
33111111111108
33111111111109
33111111111110
33111111111111
33111111111112
33111111111113
33111111111114
33111111111115
33111111111116
33111111111117
33111111111118
33111111111119
331111111111100
331111111111101
331111111111102
331111111111103
331111111111104
331111111111105
331111111111106
331111111111107
331111111111108
331111111111109
331111111111110
331111111111111
331111111111112
331111111111113
331111111111114
331111111111115
331111111111116
331111111111117
331111111111118
331111111111119
3311111111111100
3311111111111101
3311111111111102
3311111111111103
3311111111111104
3311111111111105
3311111111111106
3311111111111107
3311111111111108
3311111111111109
3311111111111110
3311111111111111
3311111111111112
3311111111111113
3311111111111114
3311111111111115
3311111111111116
3311111111111117
3311111111111118
3311111111111119
33111111111111100
33111111111111101
33111111111111102
33111111111111103
33111111111111104
33111111111111105
33111111111111106
33111111111111107
33111111111111108
33111111111111109
33111111111111110
33111111111111111
33111111111111112
33111111111111113
33111111111111114
33111111111111115
33111111111111116
33111111111111117
33111111111111118
33111111111111119
331111111111111100
331111111111111101
331111111111111102
331111111111111103
331111111111111104
331111111111111105
331111111111111106
331111111111111107
331111111111111108
331111111111111109
331111111111111110
331111111111111111
331111111111111112
331111111111111113
331111111111111114
331111111111111115
331111111111111116
331111111111111117
331111111111111118
331111111111111119
3311111111111111100
3311111111111111101
3311111111111111102
3311111111111111103
3311111111111111104
3311111111111111105
3311111111111111106
3311111111111111107
3311111111111111108
3311111111111111109
3311111111111111110
3311111111111111111
3311111111111111112
3311111111111111113
3311111111111111114
3311111111111111115
3311111111111111116
3311111111111111117
3311111111111111118
3311111111111111119
33111111111111111100
33111111111111111101
33111111111111111102
33111111111111111103
33111111111111111104
33111111111111111105
33111111111111111106
33111111111111111107
33111111111111111108
33111111111111111109
33111111111111111110
33111111111111111111
33111111111111111112
33111111111111111113
33111111111111111114
33111111111111111115
33111111111111111116
33111111111111111117
33111111111111111118
33111111111111111119
331111111111111111100
331111111111111111101
331111111111111111102
331111111111111111103
331111111111111111104
331111111111111111105
331111111111111111106
331111111111111111107
331111111111111111108
331111111111111111109
331111111111111111110
331111111111111111111
331111111111111111112
331111111111111111113
331111111111111111114
331111111111111111115
331111111111111111116
331111111111111111117
331111111111111111118
331111111111111111119
3311111111111111111100
3311111111111111111101
3311111111111111111102
3311111111111111111103
3311111111111111111104
3311111111111111111105
3311111111111111111106
3311111111111111111107
3311111111111111111108
3311111111111111111109
3311111111111111111110
3311111111111111111111
3311111111111111111112
3311111111111111111113
3311111111111111111114
3311111111111111111115
3311111111111111111116
3311111111111111111117
3311111111111111111118
3311111111111111111119
33111111111111111111100
33111111111111111111101
33111111111111111111102
33111111111111111111103
33111111111111111111104
33111111111111111111105
33111111111111111111106
33111111111111111111107
33111111111111111111108
33111111111111111111109
33111111111111111111110
33111111111111111111111
33111111111111111111112
33111111111111111111113
33111111111111111111114
33111111111111111111115
33111111111111111111116
33111111111111111111117
33111111111111111111118
33111111111111111111119
331111111111111111111100
331111111111111111111101
331111111111111111111102
331111111111111111111103
331111111111111111111104
331111111111111111111105
331111111111111111111106
331111111111111111111107
331111111111111111111108
331111111111111111111109
331111111111111111111110
331111111111111111111111
331111111111111111111112
331111111111111111111113
331111111111111111111114
331111111111111111111115
331111111111111111111116
331111111111111111111117
331111111111111111111118
331111111111111111111119
3311111111111111111111100
3311111111111111111111101
3311111111111111111111102
3311111111111111111111103
3311111111111111111111104
3311111111111111111111105
3311111111111111111111106
3311111111111111111111107
3311111111111111111111108
3311111111111111111111109
3311111111111111111111110
3311111111111111111111111
3311111111111111111111112
3311111111111111111111113
3311111111111111111111114
3311111111111111111111115
3311111111111111111111116
3311111111111111111111117
3311111111111111111111118
3311111111111111111111119
33111111111111111111111100
33111111111111111111111101
33111111111111111111111102
33111111111111111111111103
33111111111111111111111104
33111111111111111111111105
33111111111111111111111106
33111111111111111111111107
33111111111111111111111108
33111111111111111111111109
33111111111111111111111110
33111111111111111111111111
33111111111111111111111112
33111111111111111111111113
33111111111111111111111114
33111111111111111111111115
33111111111111111111111116
33111111111111111111111117
33111111111111111111111118
33111111111111111111111119
331111111111111111111111100
331111111111111111111111101
331111111111111111111111102
331111111111111111111111103
331111111111111111111111104
331111111111111111111111105
331111111111111111111111106
331111111111111111111111107
331111111111111111111111108
331111111111111111111111109
331111111111111111111111110
331111111111111111111111111
331111111111111111111111112
331111111111111111111111113
331111111111111111111111114
331111111111111111111111115
331111111111111111111111116
331111111111111111111111117
331111111111111111111111118
331111111111111111111111119
3311111111111111111111111100
3311111111111111111111111101
3311111111111111111111111102
3311111111111111111111111103
3311111111111111111111111104
3311111111111111111111111105
3311111111111111111111111106
3311111111111111111111111107
3311111111111111111111111108
3311111111111111111111111109
3311111111111111111111111110
3311111111111111111111111111
3311111111111111111111111112
3311111111111111111111111113
3311111111111111111111111114
3311111111111111111111111115
3311111111111111111111111116
3311111111111111111111111117
3311111111111111111111111118
3311111111111111111111111119
33111111111111111111111111100
33111111111111111111111111101
33111111111111111111111111102
33111111111111111111111111103
33111111111111111111111111104
33111111111111111111111111105
33111111111111111111111111106
33111111111111111111111111107
33111111111111111111111111108
33111111111111111111111111109
33111111111111111111111111110
33111111111111111111111111111
33111111111111111111111111112
33111111111111111111111111113
33111111111111111111111111114
33111111111111111111111111115
33111111111111111111111111116
33111111111111111111111111117
33111111111111111111111111118
33111111111111111111111111119
331111111111111111111111111100
3311111111111